PB88-242730

Review of the Office of Research and Development's Proposed Budget for Fiscal Year 1987

(U.S.) Environmental Protection Agency
Washington, DC

Prepared for

14 Mar 86

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. SAB-EC-86-015	2.	3. PB88-242730
4. Title and Subtitle Review of the Proposed Fiscal Year (FY) 1987 budget for the Office of Research and Development			5. Report Date March 14, 1986 6.
7. Author(s) Executive Committee			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Environmental Protection Agency Science Advisory Board 499 S. Capitol Street, SW Washington, D.C. 20460 (A101F)			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address Environmental Protection Agency 401 M Street, SW Washington, D.C. 20460 (A101)			13. Type of Report & Period Covered Final Report 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Science Advisory Board believes that its can assist the Congress in developing a more informed basis in reaching budgetary decisions for the Office of Research and Development. This view is based on a large number of EPA research program evaluations that the SAB has conducted during the past several fiscal years, as well as to the experience of individual SAB members in carrying out or managing research, and their knowledge of EPA's research efforts.

17. Document Analysis a. Descriptors

Executive Committee

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18) See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

1-a

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

March 14, 1986

OFFICE OF
THE ADMINISTRATOR

Honorable Lee M. Thomas
Administrator
U. S. Environmental Protection Agency
401 M Street, S. W.
Washington, D. C. 20460

Dear Mr. Thomas:

The EPA's independent Science Advisory Board (SAB) has completed a review of the proposed Fiscal Year (FY) 1987 budget for the Office of Research and Development which it believes can assist the Congress in developing a more informed basis in reaching budgetary decisions. The Board's review is based on the large number of EPA research program evaluations it has conducted during the past several fiscal years, in addition to the experience of individual SAB members in carrying out or managing research, and their knowledge of EPA's research efforts.

The SAB reached three major conclusions and recommendations in its review of the FY '87 research budget proposal. These include:

- The fact that the FY '87 budget does not greatly change the direction or support of the FY '86 program is a stabilizing force. In general, programs that receive greater funding in FY '87 do so at a rate at which the funds can be readily utilized. There are some research programs that we believe could benefit from additional funding. However, given the current budgetary crisis, we recommend additional funding only if Congress authorizes and appropriates new monies.

- A serious problem has evolved in the use of funds available for extramural research and development and funds devoted to in-house use. In contrast to most Federal public health and environmental research agencies, EPA's in-house program is underfunded.

- Some fiscally responsible alternatives exist to redress this problem of support for in-house research. It is for Congress to substantially raise the current ceiling of $1,000,000 before EPA is required to seek Congressional approval for reprogrammings within extramural or in-house accounts, or to authorize EPA to reprogram

funds between extramural and in-house accounts. Congress should require, however, that funds from the extramural budget that become available for in-house utilization be earmarked for the Office of Research and Development.

EPA's research program has made progress in the past several fiscal years both in achieving a more stable funding base and in making certain improvements to the research planning process. The Science Advisory Board believes it is possible to continue this progress even in the midst of the nation's difficult fiscal problems. We hope our report will assist in this effort.

Sincerely,

John Neuhold, Chairman
Research and Development Budget Subcommittee
Science Advisory Board

Norton Nelson, Chairman
Executive Committee
Science Advisory Board

-1-C

SAB-EC-86-015

Review of the Fiscal Year 1987 Budget Proposal for EPA's Office of Research and Development

Research and Development Budget Subcommittee

Science Advisory Board

U. S. Environmental Protection Agency

March, 1986

EPA NOTICE

This report has been written as a part of the activities of the Science Advisory Board, a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board is structured to provide a balanced expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency, and hence the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Table of Contents

		Page Number
Rosters:		
-	Research and Development Budget Subcommittee	iv
-	Executive Committee	v and vi
I.	Executive Summary	1
II.	Introduction	2
III.	Scope of the Report	3
IV.	Trends in the EPA Research Budget	4
V.	Comments on Specific Research Programs	9
	1) Environmental Engineering	10
	2) Quality Assurance	12
	3) Water Quality	13
	4) Biotechnology	14
	5) Non-Ionizing Radiation	16
	6) Ground Water	17
	7) Interdisciplinary Research, Including Centers and Extramural Grants	18
	8) Technology Transfer and Training	19
	9) Air Toxics/Criteria Air Pollutants	20
VI.	References	22

Research and Development Budget Subcommittee

Science Advisory Board

U. S. Environmental Protection Agency

Dr. John Neuhold, Chairman
Department of Wildlife Sciences
College of Natural Resources
Utah State University
Logan, Utah 84322

Terry F. Yosie, Director
Science Advisory Board
U. S. Environmental Protection Agency
401 M Street, S. W.
Washington, D. C. 20460

Dr. Clayton Callis
2 Holiday Lane
St. Louis, Missouri 63131

Dr. Raymond Loehr
8.614 ECJ Hall
Department of Civil Engineering
University of Texas
Austin, Texas 78712

Dr. Roger McClellan
Director, Inhalation Toxicology
Research Institute
Lovelace Biomedical and
Environmental Research Institute
P. O. Box 5890
Albuquerque, New Mexico 87185

March 1986

U.S. ENVIRONMENTAL PROTECTION AGENCY
SCIENCE ADVISORY BOARD
EXECUTIVE COMMITTEE

Dr. Norton Nelson, Chairman
Professor of Environmental Medicine
Institute of Environmental Medicine
New York University Medical Center
550 First Avenue
New York, New York 10016

Dr. Terry F. Yosie
Director
Science Advisory Board
Room 1145W, Waterside Mall
Washington, D.C. 20460

Members

Dr. Clayton Callis
2 Holiday Lane
St. Louis, Missouri 63131

Dr. Sheldon K. Friedlander
Parsons Professor of Chemical Engineering
Department of Chemical Engineering
University of California, Los Angeles
Los Angeles, California 90024

Dr. Earnest F. Gloyna
Dean, College of Engineering
Cockrell Hall, 10.310
University of Texas at Austin
Austin, Texas 78712

Dr. Richard A. Griesemer
Director, Biology Division
Box Y
Oakridge National Laboratory
Oakridge, Tennessee 37830

Dr. Rolf Hartung
School of Public Health
University of Michigan
Ann Arbor, Michigan 48109

Dr. Wendell W. Kilgore*
Department of Environmental Toxicology
University of California
Davis, California 95616

Dr. Morton Lippmann
Institute of Environmental Medicine
New York University, Lanza Laboratory
Long Meadow Road
Tuxedo, New York 10987

Dr. Raymond Loehr
8.614 ECJ Hall
Civil Engineering Report
University of Texas
Austin, Texas 78712

* Dr. Kilgore was only recently appointed to the Executive Committee and did not participate in discussions regarding this review.

Dr. William W. Lowrance
Senior Fellow and Director
Life Sciences and Public Policy Program
The Rockefeller University
1230 York Avenue
New York, New York 10021

Dr. Francis C. McMichael
Professor of Civil Engineering
Department of Civil Engineering
Carnegie-Mellon University
5000 Forbes Avenue
Pittsburgh, Pennsylvania 15213

Dr. John M. Neuhold
Department of Wildlife Sciences
College of Natural Resources
Utah State University
Logan, Utah 84322

Dr. Ellen K. Silbergeld
Senior Scientist
Environmental Defense Fund
1616 P Street, N.W.
Washington, D.C. 20036

Dr. Roger O. McClellan
Director, Inhalation Toxicology
Research Institute
Lovelace Biomedical and Environmental
Research Institute
P. O. Box 5890
Albuquerque, New Mexico 87185

Dr. Robert Neal
President, Chemical Industry
Institute of Toxicology
P. O. Box 12137
Research Triangle Park, NC 27709

Dr. William J. Schull
Director & Professor of Population
Genetics
Center for Demographic and Population
Genetics
School of Public Health
University of Texas Health Science
Center at Houston
Houston, Texas 77030

Dr. Charles Susskind
College of Engineering
University of California
at Berkeley
Berkeley, California 94720

I. Executive Summary

The President's proposed budget for Fiscal Year (FY) 1987 for the Office of Research and Development is $295.16 million, a reduction of approximately 5% from the estimated FY '86 current operating plan (including Gramm-Rudman-Hollings' reductions) of $309.86 million, not including Superfund. Given the current fiscal constraints within which the Environmental Protection Agency must operate, the Administration's total FY 87 budget proposal for EPA, including that of the Office of Research and Development, is not unreasonable.

The fact that the FY '87 budget does not greatly change the direction or support of the FY '86 program is a stabilizing force. In general, programs that receive greater funding in FY '87 do so at a rate at which the funds can be readily utilized. There are some research programs that we believe could benefit from additional funding. However, given the current budgetary crisis, we recommend additional funding only if Congress authorizes and appropriates new monies.

A serious problem has evolved in the use of funds available for extramural research and development and funds devoted to in-house use. In contrast to most Federal public health and environmental research agencies, EPA's in-house program is underfunded.

Some fiscally responsible alternatives exist to redress this problem of support for in-house research. It is for Congress to substantially raise the current ceiling of $1,000,000 before EPA is required to seek Congressional approval for reprogrammings within extramural or in-house accounts, or to authorize EPA to reprogram funds between extramural and in-house accounts. Congress should require, however, that funds from the extramural budget that become available for in-house utilization be earmarked for the Office of Research and Development.

II. Introduction

EPA was established to protect the public health and the environment against possible threats posed by physical, chemical, and biological agents. To carry out this mission, EPA establishes criteria, standards, guidelines and policies to control environmental pollutants; takes enforcement actions to ensure compliance with the Agency's regulatory actions; and maintains monitoring programs to assess changes in pollution levels over time. In addition, the Agency provides support for municipal waste treatment facilities, clean-up of hazardous wastes, and for State and other environmental programs. A significant input to Agency decision making in these areas is the development and use of scientific and technical information. Congress has recognized both the need for scientific data, and the important link between research and regulatory functions, by directing EPA to conduct research and development through various acts that authorize its activities. The Office of Research and Development (ORD) is the EPA unit specifically charged with conducting most of the Agency's research under these legislative mandates.

In carrying out its responsibilities, ORD needs to balance near-term research objectives in support of regulatory programs with longer-term research to support the same ends. In addition, research is designed to stimulate advances in the environmental sciences.

Both short-term and longer-term research can serve to support EPA's fundamental mission: to identify, assess and abate the risk of pollution to the public health and the environment. Viewed in this context, the strategic mission of ORD's research program, in both the current fiscal year and over a longer time frame, is to develop and advance the scientific and technical bases for risk management decisions.

III. Scope of the Report

One of the major responsibilities of the Science Advisory Board, as charged by the Congress, is to review the scientific quality and direction of EPA's research programs. The Board has carried out this mandate in three distinct ways, including reviews of individual research programs, assessment of the ORD five year research and development plan and evaluation of the scientific quality of risk assessment and other technical support documents. This report presents the Board's independent perspective on research priorities and support as articulated in the President's budget proposal for FY '87.

The limited time available for preparing this report led the SAB to adopt several key assumptions. First, we did not see it as our task to develop an alternative budget proposal or to analyse how effective current funds are expended, either in-house or through grants, contracts or cooperative agreements. Rather, we sought to compare the research and development priorities discussed in the budget proposal with our own knowledge of EPA's research needs gained over a decade of evaluating the quality and direction of the Agency's science. Second, this report addresses some broad trends in EPA's research and development spending in the past half decade. This particular focus on financial trends stems from our belief that a research program, to be productive, must have stability. Research productivity is more likely to result from a stable funding base than one characterized by the fits and starts of large increases or decreases in budgetary cycles. Third, we clearly recognize the fiscal constraints within which the Environmental Protection Agency operates and, given the severe budget deficits facing the nation, EPA's total FY '87 budget proposal, including that of the Office of Research and Development, is not unreasonable.

The Science Advisory Board believes that, as a representative of the scientific community and as informed citizens, it has an obligation, under its Congressional charge, to advise EPA and the Congress on research priorities that available resources should support. There is a concomitant need to provide EPA with greater flexibility in managing the expenditure of scarcer resources for research.

This report was prepared by the SAB's Research and Development Budget Subcommittee. The Subcommittee was established by the SAB's Executive Committee on January 30, 1986 following a briefing on the EPA's proposed budget for FY '87. Members of the Study Group met with the Assistant Administrator for Administration, the Acting Assistant Administrator for Research and Development, the Comptroller and other EPA staff to obtain briefings and other budgetary data needed for this review. The Subcommittee met on February 12-13 to evaluate this information and draft its preliminary report. Subsequent revisions to the draft report were incorporated through mail and telephone communications to the SAB Director. The report represents the views of both the Subcommittee and the SAB Executive Committee.

IV. Trends in the EPA Research Budget

The President's proposed budget for FY '87 for the Office of Research and Development of the Environmental Protection Agency is $295.16 million, a reduction of approximately 5% from the estimated FY '86 current operating plan (including Gramm-Rudman-Hollings' reductions) of $309.86 million. These numbers do not assume any potential research support from proposed amendments to the Superfund that would authorize research and development.

The current obligations for EPA research have tended to move upward from a low point of $215.12 million in FY '83. However, in terms of "buying power," the FY 1987 proposal (not accounting for inflation and the disruptions of up and down cycles of budgetary support) is only 37% higher than FY '83, is approximately

equal to FY 1981 expenditure levels of $295 million and is drastically below the FY '75 budget of approximately $550 million. Staffing levels have also declined markedly during this period. In FY '81, the work force consisted of approximately 2,168 Full Time Equivalents (FTE), while in FY '87 FTE levels are projected at 1,786, an additional decline of approximately 15 FTE from FY '86. Table I presents data for both budgetary and FTE levels for ORD between FY '80 and FY '87.

These budgetary and personnel figures reflect the large upheavel in EPA's research programs over this period and also aid in explaining many of the criticisms leveled at EPA by the scientific community and the Congress within the past half dozen years. The Agency is very aware of these criticisms and has achieved progress, beginning in FY '84, toward attaining a more stable funding base for its research programs and in improving the process for planning research.

The fact that the FY '87 budget does not greatly change the direction or support of the FY '86 program is a stabilizing force. In general, programs that receive greater funding in FY '87 do so at a rate at which the funds can be readily utilized. There are some research programs that we believe could benefit from additional funding. However, given the current budgetary crisis, we recommend additional funding only if Congress authorizes and appropriates new monies.

Another factor that significantly influences EPA's research and development capability is the flexibility to manage the program. ORD funds are appropriated in two categories, salaries and expenses (S&E) and extramural research and development (R&D). Salary and expense funds provide funding for staff salaries and the major in-house research programs that are conducted by ORD laboratories and field stations. In general, research and development funds include research conducted by extramural scientists and engineers that is directed toward developing fuller scientific knowledge of such issues as environmental processes, transport and fate of pollutants and health effects research and assessment, quality assurance,

TABLE I

OFFICE OF RESEARCH AND DEVELOPMENT BUDGETARY AND PERSONNEL RESOURCES--FY '80 THROUGH FY '87*

	$ in Millions (Including Salaries and Expenses and Extramural Research and Development)	FTE
FY '80 Actuals	336.47	2,344.3
FY '81 Actuals	299.04	2,167.7
FY '82 Actuals	244.69	1,982.0
FY '83 Actuals	215.12	1,853.2
FY '84 Actuals	234.84	1,782.9
FY '85 Actuals	286.95	1,804.6
FY '86 Current Operating Plan	309.86	1,801.6 +
FY '87 Proposal	295.16	1,786.2 +

* Supplied by the Office of Research and Development on March 12, 1986

\+ If Superfund FTE was included as in prior years, these figures would be 1864.6 in FY '86 and 1849.2 in FY '87. Because the reauthorization of Superfund has not occurred, the Agency budget submission excludes Superfund in all numbers displayed.

as well as EPA sponsored scientific workshops and peer reviews. Both research and development and salary and expense funds have the common purpose of improving the technical basis for regulatory decision-making, and ORD managers seek to ensure that extramural spending complements in-house research efforts. The separation between S & E and extramural R & D funds is not always clear, and the Subcommittee recommends more specific and consistent definitions of how EPA defines and uses such resources.

Over a number of fiscal years, however, a serious underfunding of the salary and expense account has occurred due to rising costs of equipment and other research expenses. Figure I illustrates this development as it has evolved from FY '83 through FY '87. A very modest beginning toward increasing in-house S & E resources is recommended in the FY '87 proposal, but even greater support is needed.

This need results from several factors. Because extramural research and development funds cannot be expended in-house and since the majority of the internal salary and expense account is consumed by staff salaries, only a small portion of the total budget is available for actual in-house research. In addition, in-house staff supervise and monitor external grants and contracts. As a result, salary and expense monies function as a part of the overhead for managing the extramural research and development program.

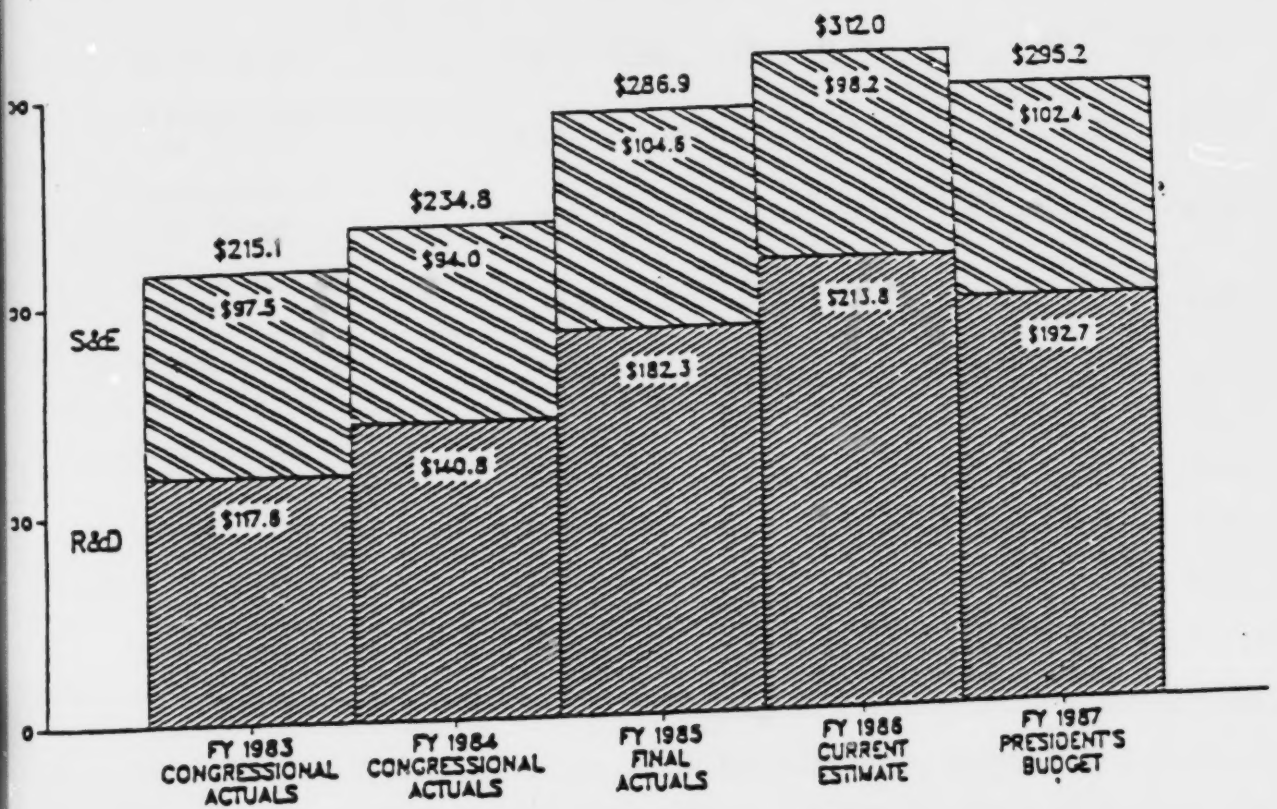
A further indication of the limitations on EPA's internal research capabilities derives from a comparison of the cost per FTE at EPA and other public health or environmental research organizations in the Federal government. Table II presents such a comparison for various object classes of expenditure for FY '86. EPA's research program represents a relatively low cost investment that, with increased in-house resources, has the capability to achieve higher levels of productivity.

Figure I

THE FY 1987 ORD BUDGET REFLECTS A STABILIZED RESOURCE BASE FOR THE AGENCY'S RESEARCH AND DEVELOPMENT PROGRAM

($ IN MILLIONS: EXCLUDES SUPERFUND RESEARCH)

Reproduced from best available copy.



S & E	45.3%	40.0%	36.5%	34.2%	34.7%
R & D	54.7%	60.0%	63.5%	65.8%	65.3%

TABLE II

COMPARISON OF COST PER FTE FOR VARIOUS OBJECT CLASSES

AT SELECTED FEDERAL AGENCIES ($ IN THOUSANDS)

FY '86 PRESIDENT'S BUDGET

OBJECT CLASS	NCI	NIEHS	NBS	NOAA	CDC	FDA	EPA/ORD
Travel/Transportation of Persons	2.23	1.08	1.14	1.40	1.60	1.37	1.55
Transportation of Things	0.30	0.19	0.26	0.41	0.43	0.27	0.27
Comm. Util. and Rent	3.41	10.84	5.63	4.56	2.91	2.21	1.86
Printing and Reproduction	2.45	0.31	0.18	0.25	0.33	0.47	0.41
Supplies and Materials	11.97	10.75	3.56	3.11	7.02	1.81	2.26
Equipment	4.03	8.18	4.01	2.51	5.42	2.17	2.44
TOTAL ----------	24.39	31.35	14.78	12.24	17.71	8.30	8.79

SOURCE: FY 1986 BUDGET APPENDIX

Some fiscally responsible alternatives exist to redress this underfunding of the salary and expense accounts. It is for Congress to substantially raise the current ceiling of $1,000,000 before EPA is required to seek Congressional approval for reprogramming elements within extramural R & D or in-house S & E accounts, or to authorize EPA to reprogram funds between extramural and in-house accounts. Congress should require, however, that the extramural research and development resources that become available for in-house utilization be earmarked for the Office of Research and Development.

V. Comments on Specific Research Programs

The FY '87 budget proposal for the Office of Research and Development contains no "shocks" or major redirections of effort from the FY '86 program.

A number of individual programs experience modest funding increases, while other program cuts are made to offset such increases and operate the program at the proposed level of funding for FY '87. Only one major program, synfuels research, is eliminated, and the Subcommittee concurs that this program is not a high priority because of tight budgets and developments in the energy market.

The Subcommittee has not evaluated in detail every major component of the research program. It has focused, instead, on particular areas of need. The following represent the topics of the Subcommittee's chief concerns or comment.

1) Environmental Engineering

The FY '87 budget decreases by $13.51 million the funds available in the current fiscal year for environmental engineering and technology research. This decrease occurs in all program categories except pesticides (where funds will be devoted to evaluating protective garments for pesticide applicators and formulators) and accounts for about 83% of the overall decrease in the ORD budget. Over half of the decrease results from the proposed elimination of funding for the Tufts University hazardous wastes center and reductions in support for the limestone injected multi-stage burner technology.

The Science Advisory Board is concerned about the general decline of support for environmental engineering research during the past half decade. One rationale for a decreased engineering research program in EPA stems from an inaccurate perception that private industry is now in a position to perform many of the engineering evaluations and studies. This concept is a myth and has been refuted by a study prepared for EPA by the ICF Corporation. The Science Advisory Board completed a review of this report on October, 1985. The members of the SAB review subcommittee included individuals from the private sector.[1]

The ICF report noted that:

- The industrial sector has little economic incentive to develop technologies which significantly reduce the emission of pollutants below permit levels.
- In industry, the first area of reducing overhead monies is in the area of research and development.
- Many individuals in industry view return on pollution control investment as not being worth the risks, resulting in inordinately low pollution control technology expenditures by the private sector.

The SAB review concurred with these conclusions and noted that the Federal government has an important and unique role in developing pollution control technology since such technology is more in the public interest than in the interest of a particular industry. Thus, a cornerstone in the logic for decreasing emphasis on pollution control technology research is based on an inaccurate premise.

The decrease in environmental engineering and technology research for hazardous wastes is particularly distressing. In the area of land disposal research, the decrease has been approximately 33% since 1985 ($2.89 million) and 16% since 1986 ($1.11 million). It is appropriate that control technology focus on approaches other than land disposal. However, the alternate technology research budget decreased between Fiscal Years '85 and '86 and increased only $870,000 between Fiscal Years '86 and '87. Thus, the decrease in land disposal technology research in the past two years ($2.89 million) is considerably greater than the small increase in alternative technology research ($0.87 million).

Throughout the discussions of research initiatives and of research budget changes, there is no obvious mention of research related to bioaccumulation, especially as it pertains to hazardous waste treatment and disposal. Bio-accumulation concerns are expressly identified in the 1984 RCRA Amendments. To date, there appears to be a policy of benign neglect concerning the importance

of this issue. Very little research funds have been programmed to evaluate this topic. This "neglect" does not seem consistent with the intent of Congress. The Subcommittee recommends that future Administration budgets provide greater attention to this issue.

In the event that there are increases in the ORD budget in the near future, it is recommended that such increases be allocated to:

- Demonstration of alternative and innovative technologies for application to RCRA and CERCLA problems.
- Increased pollution control technology research and development efforts especially in the drinking water, hazardous waste, air and sludge management program categories.
- Development of quality assurance and quality control (QA/QC) procedures especially for hazardous waste and CERCLA research, development and demonstration programs and for related analytical procedures.

2) Quality Assurance

Overall, the research funds devoted to quality assurance (QA) are decreased by about $712,000. An increase of approximately $166,000 is provided in the FY '87 budget for the Agency's mandatory quality assurance program funded in the interdisciplinary budget account. However, this increase does not restore such funds to the FY '85 level. In addition, this increase will be used for audits and preparation of status reports. EPA will not utilize these resources for improving QA procedures or the SW-846 analytical procedures. The SW-846 procedures are key analytical procedures for hazardous waste research and development efforts.

A review of the hazardous waste ORD funds reveals that the 1987 budget contains decreased funds for QA support. However, a bill before the Congress would establish a cost recovery authority that would enable EPA to accumulate funds in its general

research and development account. The Subcommittee believes that such revenues could offset reductions in QA and could support such efforts as the RCRA land disposal banning decisions and CERCLA cleanups.

3) Water Quality

Research in water quality shows a decline of approximately $3.34 million from FY '86. EPA hopes to recover approximately $0.75 million through Congressional passage of the quality assurance cost recovery legislation.

Among the reasons cited to support the FY '87 reduction are the completion of a number of research projects related to water quality criteria for aquatic life and the completion of biological integrity and incineration at sea research. In 1985, the Science Advisory Board reviewed the Agency's revised Guidelines for Water Quality Criteria.[2] While the Board noted that the Agency had made progress in developing a more scientifically sophisticated and realistic set of Guidelines, it concluded, and EPA technical staff agreed, that major areas of uncertainity remained. The Board recommended, for example, that organisms used for future studies should be selected for the role they play in ecosystems, if ecosystem impact is to be reasonably approximated; and that EPA should acknowledge that interactions among chemicals are a reality that should be considered in criteria setting, and that the Agency should begin to examine the problem of mechanisms of toxicity as a means of developing predictive responses to chemical mixtures. The budgetary rationale that funding decreases result from the completion of existing water quality criteria projects is, therefore, unpersuasive.

EPA is experiencing major difficulty in gaining public acceptance for permitting ships that incinerate hazardous wastes at sea. One of the significant reasons for public mistrust is the Agency's inability to definitively answer a host of difficult technical questions relating to whether incineration will cause adverse effects on the marine environment. These issues include:

- Better characterization of incinerator emissions and effluents so that the identify and quantity of chemicals released into the environment can be estimated.
- Determination of emissions under all operating conditions.
- Development of an integrated research strategy involving laboratory toxicity studies and field assessments to address the possibility of both short-term and long-term health and environmental effects.
- Investigation of the role of the ocean microlayer in the transport and concentration of emitted chemicals.
- Development of methods to identify the potential of chemicals in incinerator emissions to biomagnify.

EPA's ability to resolve these and other technical issues related to chemical incineration at sea, and its efforts to gain public acceptance of this technology, would improve if it developed a national, well-funded and well-coordinated research program.

Support for Great Lakes research is also reduced in the 1987 budget. The decrease is about $1.52 million and represents a reduction of about 62% in one year. Water in the Great Lakes affects a major fraction of the population as a resource for fishing, recreation, and water supply. Such a drastic decrease seems inconsistent with the impact of these waters on the United States. Research also needs to be continued in order to fulfill EPA's international treaty obligations. If new monies became available, the Subcommittee recommends funding the Great Lakes program at least at the FY '86 level.

4) Biotechnology

The recommended addition of $1.97 million for biotechnology is welcome for at least two reasons. The rate of increase will supplement an already

growing program which is able to effectively use these funds. This is preferable to instituting a higher cost crash research program. Second, while EPA has already initiated research on survival, growth and genetic transfer of engineered organisms, it needs to begin or accelerate work in at least four additional areas.[3] These include:

- Dissemination--an adequate base of information needs to be developed on the dispersal of genetically engineered micro-organisms.
- Remedial Action--research should be initiated to develop methods for clean-up and containment in the event of the dissemination of a harmful organism.
- Environmental Effects--the Agency has essentially no program in this area. The EPA should mount a research effort to assess possible perturbations in natural communities related to genetically engineered micro-organisms. Research also should be conducted on the use of microcosms as models for natural communities, using the microcosms to evaluate effects of viable agents, as has been done for chemicals. The feasibility of the testing protocols and the validity of the risk assessment procedures might be tested using naturally occurring or genetically engineered micro-organisms specifically selected or designed to bring about the inactivation and degradation of environmental pollutants.
- Health Effects--the scientific staff should, at a minimum, be involved in the following health effects activities: (a) development of test protocols, building upon and revising the existing protocols in Subdivision-M of the Pesticide Assessment Guidelines; (b) technical assistance on current information and emerging trends in health effects and biomedical mechanisms. Staff should draw upon the relevant reference materials, published

literature, computerized data bases, regular contacts with outside scientists, scientific societies, and their own research. One objective of this function is to facilitate both industrial and in-house selection of micro-organims least likely to present health risks--based upon an ongoing analysis of the features of pathogenicity, including propensity for exchange of genetic material; and (c) an expanding program of well-focussed, peer reviewed intramural research, supported in order to attract and retain able scientists who can meet the regulatory science needs and interact with extramurally supported scientists.

5) Non-Ionizing Radiation

EPA eliminated its program in non-ionizing radiation research in FY '86. This decision was made on the basis of the need to make difficult budgetary choices and the fact that EPA's radiation budget is relatively small in comparison to research carried out or sponsored by other Federal agencies.

The results of investigations in the past several years in this field have served to confirm the importance of non-ionizing radiation as a higher priority for decision makers. EPA will soon publish nonionizing radiation protection guidance. The Subcommittee understands that the guidance does not address low-level and modulation effects because the information to make judgments on how to address them is not yet available. The FY '87 budget proposal does not acknowledge that this and other information is needed.

The Congress and EPA should re-establish a program of extramural and in-house research on the health effects of radiofrequency radiation. This is necessary not only to keep abreast of the field, but also because the research itself is invaluable to the nation, as attested by the fact that a considerable part of the scientific results reported in the Agency's recent (1984) review of

the literature, and much of the technical basis for the proposed guidance, derives from work done at its own laboratories. Among possible topics for future research, the Subcommittee enumerates the following:

- Effects of modulation imposed on radiofrequency carriers, particularly modulation at very low frequencies, on biological specimens exposed to very low power densities.
- Effects of chronic vs. acute exposures, and of partial-body vs. whole-body exposures.
- Effects of exposure to pulsed sources of very high peak power vs. sources that are adequately characterized by average power.
- Synergistic effects of radiofrequency energy with other physical and chemical agents.
- Testing the validity of recent results with regard to mutagenic and similar effects observed at low power densities.
- Evaluation of the thermo-regulatory capability and concomitant physiological processes of various populations exposed under extreme environmental conditions.[4]

The Subcommittee does not recommend a crash program, but it seeks to alert EPA and the Congress that abolition of the non-ionizing research program was a mistake that ought to be corrected.

6) Ground Water

The FY '87 budget proposes an increase in ground water research of $0.05 million for a total budget of $21.07 million, excluding Superfund resources. Two program elements account for the augmented resources: long term exploratory research implemented through ORD's competitive grants program; and pesticides and toxics--to determine the effects of ground water contamination by pesticides. These increases will be offset by a reduction

of approximately $0.49 million in drinking water/ground water research related to environmental processes.

The Subcommittee applauds the increased, yet measured rate of support for ground water research. Recognizing the overall need for even greater resources, the Subcommittee re-affirms the earlier recommendations of two Science Advisory Board committees to amend Superfund to authorize additional ground water research, as well as research on other significant hazardous waste-related problems.[5]

7) Interdisciplinary Research, Including Centers and Extramural Grants

A major rationale for the establishment of the university-based centers program was to carry out research designed to meet EPA's longer-term information needs as identified by the Congress, the National Research Council, the Office of Technology Assessment, and EPA advisory committees and task forces. When EPA established eight centers between 1979 and 1981, both the selected universities and many officials in the Office of Research and Development held high expectations regarding the program's potential. EPA officials, in particular, saw the program as a means to establish more formal linkages to the scientific community, with the hope that such ties would advance both scientific knowledge and the credibility of the Agency's research program.

In the intervening years, both the centers and EPA experienced great difficulties due primarily to instability in funding and changing management at the Agency. Subsequent changes, beginning in FY '85, partially remedied these problems, with the result that the centers enjoy a more stable funding base. The FY '87 proposal reflects this relative improvement in program stability, for in a period of increasingly scarce resources, the Agency has recommended a marginal increase of $0.40 million for a total of $4.8 million. This would enable each center to achieve an average funding level

of $0.60 million. Even this amount, however, is below the minimum level of $0.80 million to $1.00 million that would constitute a critical mass of staff and research support for each center.[6]

In contrast to the centers program, EPA plans to reduce support for extramural grants by $3.5 million for a total level of support of $8.3 million. The rationale for the reduction states that the number of new grants awarded will be reduced in order to focus resources on high priority research areas. The statement fails to recognize the fact that EPA conducts a "relevence test" before deciding to award grants, and it contradicts the assertions of numerous EPA officials over a number of years that the grants program already focused, in broad terms, on high priority research needs. The Subcommittee recommends restoration of the deleted funds for the extramural grants program.

8) Technology Transfer and Training

On two occasions within the past year the Science Advisory Board has called attention to the need for a much greater EPA-wide effort in technology transfer and training. In ground water, for example, this need applies both to the large in-house staff in ORD and the regulatory offices working on ground water-related issues without adequate experience or training, and to State and local governments on whom EPA ultimately depends for proper ground water management.

A critical shortage of trained ground water personnel exists within EPA and State governments. The problem is particularly acute for EPA because the Agency has a large pool of undertrained professionals who are forced by current operational requirements to make decisions on ground water protection on a daily basis. An in-house training center could provide training tailored to regulatory program requirements that would greatly ameliorate the training problem. This training should be not

only for Headquarters and Regional staff, but also for State and local personnel upon whom EPA will depend when the Ground Water Strategy is implemented.[7]

In another instance, the SAB reviewed the Agency's dioxin research program. Some of the project officers presenting the research sponsored by the Agency were not thoroughly familiar with the work conducted. The Subcommittee believes that part of this problem may be due to inadequate technical skills in the in-house staff involved as project officers on these programs.[8]

Both of these examples, and other ones that could be cited, document the inadequacy of the level of support proposed tor technology transfer and training. The FY '86 amount of $1.55 million, largely for technology transfer, does not meet ORD's needs, and further reducing this by $3,000 is a step in the wrong direction.

9) Air Toxics/Criteria Air Pollutants

Research support in FY '87 for hazardous air pollutants will experience an increase of $3.21 million, while the budget for research to support the development of National Ambient Air Quality Standards will be reduced by $2.35 million.

The increased priority placed on Air Toxics by EPA and the Congress, in addition to public concerns, justifies the added research funding in this program category. EPA plans to expand its efforts to develop ambient and source monitoring methods. The Total Exposure Assessment Methodology (TEAM) will be employed to assess human exposure to total air pollutants. This represents a positive step in responding to a 1985 SAB conclusion that TEAM "provides compelling evidence of the necessity of evaluating total human exposure and of not basing exposure estimates on pollutant concentrations

measured only by fixed station monitors."[9] In addition, the increased budget will support work to evaluate the effects of acute exposures, continued engineering research on measuring emissions from wood combustion, and additional work on test methods and dose response studies of the potential genetic, neurologic, pulmonary, carcinogenic and mutagenic effects following exposure to hazardous air pollutants.

The rationale for a decreased budget for criteria air pollutants is not persuasive. The budget proposal provides for continuing work on the respiratory, biochemical and immunological effects of ozone, particulate matter and sulfur dioxide, and the neurobehavioral effects of carbon monoxide. However, the revised standard for nitrogen dioxide, which EPA promulgated on June 19, 1985, rests upon a very fragile scientific base. In addition, the Agency specifically deferred making a decision on whether to set a short-term standard for nitrogen dioxide because of the magnitude of the scientific uncertainties associated with short-term exposures. EPA has also recently committed itself to assessing the need for a separate ambient air quality standard for acid aerosols. Finally, an increasing body of scientific evidence is accumulating that questions whether the current ozone standard is sufficiently protective of public health, and whether alternate averaging times should be developed for a revised standard. Given the large public health and economic implications of ozone control, additional funding is warranted. Congress should modify the budget proposal for FY '87 to provide additional research support for these EPA priorities.

VI. References

1. "Review of ICF Report: Pollution Control Technology Research and Development-Private Sector Incentives and the Federal Role in the Current Regulatory Systems," Environmental Engineering Committee, Science Advisory Board, U. S. EPA, October, 1985.

2. "Water Quality Criteria," Environmental Effects, Transport and Fate Committee, Science Advisory Board, May 10, 1985.

3. "Report of the Study Group on Biotechnology," Science Advisory Board, February 7, 1986.

4. "Review of EPA's Biological Effects of Radiofrequency Radiation," Subcommittee on the Biological Effects of Radiofrequency Radiation, Science Advisory Board, April 25, 1984.

5. "Report on the Review of the Environmental Protection Agency's Ground Water Research Program," Ground Water Research Review Committee, Science Advisory Board, July 31, 1985.

   "Resolution on Superfund Re-Authorization," Environmental Engineering Committee, Science Advisory Board, October 30, 1985.

6. "Review of the Research Centers Program of the Office of Research and Development," Report of the Subcommittee on Strategic and Long-Term Research Planning, Science Advisory Board, August 1, 1984.

7. Report of the Ground Water Research Review Committee.

8. "Review of the Status of Dioxin Research in the United States Environmental Protection Agency," Dioxin Research Review Subcommittee, Science Advisory Board, January 24, 1986.

9. "Review of the Agency's Ongoing Research In Understanding Total Human Exposure to Indoor and Ambient Air Pollution," Report of the Review Panel on Total Human Exposure, Science Advisory Board, April 26, 1985.